

Amendment and Response

Applicant: Raymond H. Kraft

Serial No.: 10/800,420

Filed: March 12, 2004

Docket No.: A126.253.102

Title: SYSTEM AND METHOD OF NON-LINEAR GRID FITTING AND COORDINATE SYSTEM MAPPING**REMARKS**

This is responsive to the Non-Final Office Action mailed October 14, 2011. In that Office Action, claims 1-7, 16-20 and 29-39 were rejected. With this Response, claims 1, 2, 16, 29, and 37 have been amended. Claim 40 has been added. Claims 1-7, 16-20, and 29-40 remain pending in the application and are presented for reconsideration and allowance.

Miscellany

Applicant appreciates the opportunity to discuss the application with the Examiner on February 14, 2012.

35 U.S.C. §103 Rejections

Claims 1-2, 4-6, 16-17, 19-20, 29-30 and 32-39 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Michael et al., U.S. Patent No. 5,768,443 ("Michael") in view of Nonay et al., U.S. Patent No. 6,618,494 ("Nonay").

Claims 3, 18 and 31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Michael in view of Nonay, and further in view of Thompson, U.S. Patent No. 5,020,123 ("Thompson").

Claims 7 and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Michael in view of Nonay, and further in view of Leonard et al., U.S. Patent No. 7,034,272 ("Leonard").

Amended independent claim 1 includes the features of translating an imaging apparatus across a plane parallel to the fiducial plate to capture image data such that image features of the image data is captured at discrete locations and positioned in space relative to the fiducial plate, fitting a fiducial grid model to the image data acquired by the imaging apparatus for each discrete location to identify image feature centers, establishing a conversion from coordinates obtained from the image data to ideal fiducial coordinates using a data processing component based on fitting the fiducial grid model for each discrete location, calculating an absolute location for each identified acquired image feature center relative to the fiducial plate in fiducial

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plate coordinates based on the conversion using the data processing component, the absolute location indicating a distance measurement in fiducial plate coordinates. Applicant respectfully submits that the cited references do not teach or reasonably make obvious at least these features.

In contrast, Michael discloses using a multi-camera machine vision system in which each of a plurality of cameras simultaneously acquires an image of a different portion of the object of interest. *Michael at Abstract; col. 2, ll. 2-5.* Michael further discloses that a number of calibration targets on the substrate is determined by the number of possible camera locations that may be used during a run-time phase and provides an example of using three or four cameras and a set of seven possible locations for each of the three or four cameras. *Michael at col. 3, l. 66 to col. 4, l. 4; see also FIG. 5.* In any event, Michael does not disclose run-time grid fitting, establishing a conversion or calculation of an absolute location, as otherwise provided in amended claim 1.

Paramount among the deficiencies of Michael is that Michael does not disclose translating an imaging apparatus across a plane parallel to the fiducial plate, much less provide grid fitting, establishment of a conversion and position calculation based on image data acquired during translation. Instead, Michael explicitly discloses transformation between coordinates during calibration such that then one or more cameras may be positioned as a function of the calibration. No discussion is made that could otherwise be construed as, for each discrete location, of an imaging apparatus translated with respect to a fiducial plate, fitting a grid, establishing a conversion or calculating an absolute location. In Michael, a distortion-correction map is generated from calibration target images such that, after run-time data is acquired, the distortion-correction map (i.e., a single map developed during calibration) is applied to the data. This process is distinct from the method of claim 1, which performs calculation for multiple discrete locations of an imaging apparatus.

Nonay does not cure the deficiencies of Michael. Nonay merely discloses use of a CCD camera to capture an image. *Nonay at col. 3, l. 61.* Nonay makes reference to optical distortion correction generally and not to grid fitting for discrete locations of an imaging apparatus translated with respect to a fiducial plate. Thus, the cited references do not teach or reasonably

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make obvious translating an imaging apparatus across a plane parallel to the fiducial plate to capture image data such that image features of the image data is captured at discrete locations and positioned in space relative to the fiducial plate as presently recited.

Amended independent claims 16, 29 and 37 include similar features to those discussed above with respect to amended independent claim 1. Thus, for the same reasons as discussed above with respect to claim 1, the cited references do not teach or reasonably make obvious each and every feature of claims 16, 29, and 27.

Further, with respect to the features of fitting a fiducial grid model to the image data acquired by the imaging apparatus for each discrete location to identify image feature centers as recited in amended independent claim 1 (and similarly included in amended independent claims 16 and 37), the cited references do not teach or reasonably make obvious these features. In contrast, Michael discloses that each of the calibration targets 12, 14, 16 shown in FIG. 1 includes a regular array of dots 24 for use in camera distortion correction, and a pair of non-parallel lines 26 for use as a position-determination “landmark.” *Michael at col. 4, ll. 25-28*. Further, Michael discloses that any graphical design that provides a regular array of features can be used as a calibration target. *Michael at col. 4, ll. 33-34*. Nonay does not cure the deficiencies of Michael. Accordingly, the cited references do not teach or reasonably make obvious fitting a fiducial grid model to the image data acquired by the imaging apparatus for each discrete location to identify image feature centers as presently recited.

In addition, independent claim 37 includes the features of the discrete locations being less than or equal to half of a center-to-center fiducial spacing as measured on the fiducial plate. Furthermore, claim 37 includes the features of determining an actual position of the object with respect to the plurality of fiducial marks using the model fitted to the image of the plurality of fiducial marks as the imaging apparatus is translated. In contrast, Michael merely discloses that it may be advantageous for the substrate to include a regular array of calibration targets having systematic inter-target spacing. *Michael at col. 4, ll. 10-12*. A pair of non-parallel lines 26 may be used as a position determination “landmark.” *Michael at col. 4, ll. 26-27*. However, the cited references do not teach or reasonably make obvious discrete locations being less than or equal to

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half of a center-to-center fiducial spacing as measured on the fiducial plate as presently recited or that determination of position is made as the imaging apparatus is translated.

In view of the above, independent claims 1, 16, 29, and 37 are believed allowable over the cited references. Dependent claims 2-7 further define patentably distinct independent claim 1. Dependent claims 17-20 further define patentably distinct independent claim 16. Dependent claims 30-36 further define patentably distinct independent claim 29. Dependent claims 38-39 further define patentably distinct independent claim 37. Accordingly, these claims are also believed allowable over the cited reference. Therefore, Applicant respectfully submits that the rejection to claims 1-7, 16-20, and 29-39 under 35 U.S.C. §103(a) should be withdrawn.

Newly Presented

Claim 40 further defines claim 1 and is newly presented herein. Claim 40 recites that the image data includes object data and fiducial data. Applicant respectfully requests allowance of claim 40.

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In view of the above, Applicant respectfully submits that pending claims 1-7, 16-20, and 29-40 are in form for allowance and are not taught or suggested by the cited references. Therefore, reconsideration and withdrawal of the rejections and allowance of claims 1-7, 16-20, and 29-40 is respectfully requested.

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471.

Please consider this a Petition for Extension of Time for a sufficient number of months to enter these papers, if appropriate. At any time during the pendency of this application, please charge any additional fees or credit overpayment to Deposit Account No. 500471.

The Examiner is invited to contact the Applicant's representative at the below-listed telephone numbers to facilitate prosecution of this application.

Any inquiry regarding this Amendment and Response should be directed to Annette L. Martin at Telephone No. (612) 767-2505, Facsimile No. (612) 573-2005. In addition, all correspondence should continue to be directed to the following address:

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Respectfully submitted,

Raymond H. Kraft,

By his attorneys,

Date: March 14, 2012

ALM:cjs

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